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Iron Ore

UNITED STATES DEPARTMENT OF THE INTERIOR

The statistical data in this volume represents the most comprehensive, verified, domestic and international coverage for 1987 at the time the volume went to press. More recent information can be found in the monthly Iron Ore Mineral Industry Surveys obtainable from Publications Distribution, Bureau of Mines, Box 18070, Cochrans Mill Road, Pittsburgh, PA 15236.

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UNITED STATES DEPARTMENT OF THE INTERIOR • Manuel J. Lujan, Jr., Secretary

BUREAU OF MINES • T S Ary, Director

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Iron Ore

By Peter H. Kuck[1]

The fortunes of the domestic iron ore industry made a turn for the better in 1987. First, USX Corp. and the United Steelworkers of America (USWA) settled their 184-day labor dispute in February. Second, there was a growth in overall demand for steel products during the fall. Mine shipments of agglomerates and ore rose to 47 million tons[2] from a depressed level of 39 million tons in 1986. Yearend stocks of ore and agglomerates at U.S. furnace yards were at their lowest levels in more than three decades. The restructuring and recapitalization of the iron ore industry in the United States and Canada, begun in 1986, continued. For the first time in 9 years, the U.S. industry did not close or indefinitely idle any of its pelletizing operations. Installed pelletizing capacity was 75 million tons, down from 90 million tons in 1980—a pivotal year for the industry.

Significant strides were made in lowering operating costs and improving productivity. New labor contracts were signed at most of the mining complexes in the Lake Superior district. The USWA agreed to wage freezes or cuts in exchange for increased job security and participation in future profit sharing. Improved demand led to increased utilization of effective pelletizing capacity, which also helped to lower unit costs. Several pelletizing plants began producing fluxed pellets in addition to the traditional acid pellets. Although more expensive to produce, the fluxed pellets help to reduce operating costs at the blast furnace by lowering coke consumption, increasing the rate of the smelting reaction, increasing the life of the refractory lining of the furnace, and improving the reliability and stability

Table 1.—Salient iron ore statistics

(Thousand long tons and thousand dollars unless otherwise specified)

	1983	1984	1985	1986	1987
United States:					
Iron ore (usable[1] less than 5% manganese):					
Production	37,562	51,269	48,751	r38,862	46,817
Shipments	44,596	50,883	49,411	41,327	47,146
Value	$1,914,988	$2,247,686	$2,076,730	$1,472,511	$1,503,087
Average value at mines, dollars per ton	$43.61	$44.17	$42.03	$35.63	$31.88
Exports	3,781	4,993	5,033	4,482	5,013
Value	$182,744	$239,257	$240,557	$204,738	$198,254
Imports for consumption	13,246	17,187	15,771	16,743	16,583
Value	$445,731	$529,065	$452,267	$460,643	$408,783
Consumption (iron ore and agglomerates)	70,629	72,514	70,575	61,116	66,698
Stocks, Dec. 31:					
At mines[2]	4,122	5,265	5,951	3,255	2,261
At consuming plants	25,494	24,017	21,280	17,163	16,304
At U.S. docks	3,174	2,942	2,404	1,987	2,024
Manganiferous iron ore (5% to 35% manganese): Shipments	30	79	18	13	W
World: Production	r728,247	r822,824	844,738	p854,726	e869,127

eEstimated. pPreliminary. rRevised. W Withheld to avoid disclosing company proprietary data.

[1]Direct-shipping ore, concentrates, agglomerates, and byproduct ore.

[2]Excludes byproduct ore. These stocks are not comparable to those of previous years owing to the reclassification of some stocks from the usable to the byproduct category.

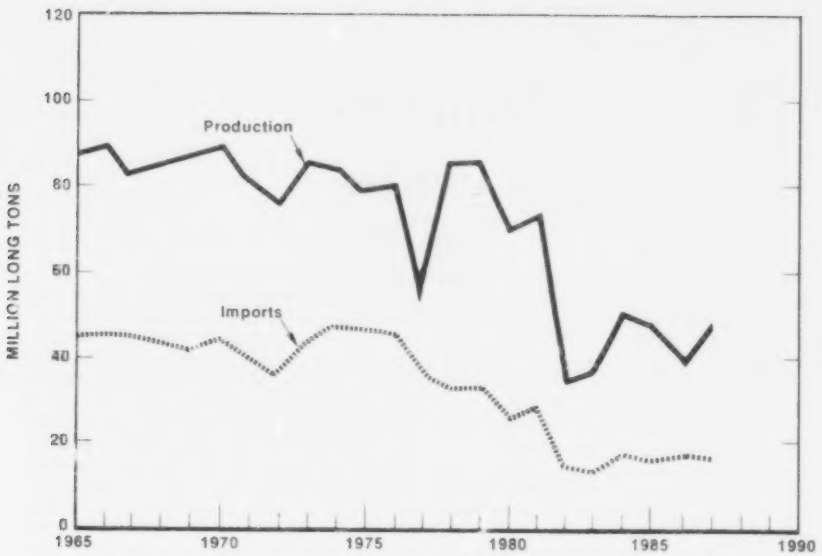

Figure 1.—U.S. iron ore production and imports for consumption.

of the furnace operation. The weakening of the U.S. dollar against the Japanese yen and several European currencies helped to improve pellet demand by slowing imports of finished steel into the United States and encouraged domestic hot metal production. The improvements in domestic mining and pelletizing productivity made it more difficult for foreign producers to sell pellets in the Great Lakes and Ohio River Valley regions. Because of reduced production costs, the U.S. Lower Lakes list price had dropped dramatically since 1984 and was much closer to the prevailing Rotterdam spot pellet price.

Consumption and trade of iron ore improved slightly in the rest of the world. Nonetheless, excess capacity to produce lump ore and sinter fines continued to overhang the international market. World prices for lump and fines continued their downward trend from 1982. Demand for pellets, in contrast, tightened somewhat. Cutbacks in demand for ore from Japan were offset by the expansion of hot-metal operations in Indonesia, the Republic of Korea, and other newly industrialized countries. Imports into the 12-member European Communities (EC) had been relatively constant since 1984 and totaled about 119 million tons in 1987. Ocean freight rates rose from the depressed levels of 1986, giving exporters like Brazil, with ports closer to Western Europe, an advantage over more distant exporters like Australia.

Domestic Data Coverage.—U.S. production data for iron ore are developed by the Bureau of Mines from three separate voluntary surveys of domestic operations. The annual "Iron Ore" survey (1066-A) provides the basic data used in this report. Of 33 addressees to whom the 1066-A form was sent, 32 responded, representing 99.98% of the total production shown in tables 1 through 4. Production for nonrespondents to the annual survey can be estimated from monthly surveys (1066-M), from railroad reports, or from reported production levels in prior years. This information may be supplemented by employment data, mine-inspection reports, and information from consumers. Consumption data were mostly provided by the annual "Blast Furnace and Steel Furnace" survey (1067-A). Data coverage for this survey is reported in the "Iron and Steel" chapter.

EMPLOYMENT

Statistics on employment and productivity in the U.S. iron ore industry in 1987, shown in table 2, were derived from quarterly employment data supplied by the Mine Safety and Health Administration (MSHA) of the U.S. Department of Labor and from production data derived from Bureau of Mines surveys. Both sets of data were obtained from producers' reports.

The statistics include production workers employed at mines, concentrators, and pelletizing plants, and in repair and maintenance shops, but do not include 693 persons engaged in management, research, or office work at mines and plants. Employees engaged in ore preparation, such as sintering, at blast furnace sites are not included. An additional 234 individuals were engaged in the secondary beneficiation of iron ore for heavy media and other nonsteel uses.

Because employment data reported to MSHA are primarily for safety analysis, hours spent by salaried employees in mines or plants may be included by operators in the total number of hours worked at individual mines or plants. This has resulted in understatement of calculated productivity by 10% to 25% for some operations, but its effect on others is not known. If company reporting practice is consistent, however, comparison of productivity from one year to the next should be reasonably valid.

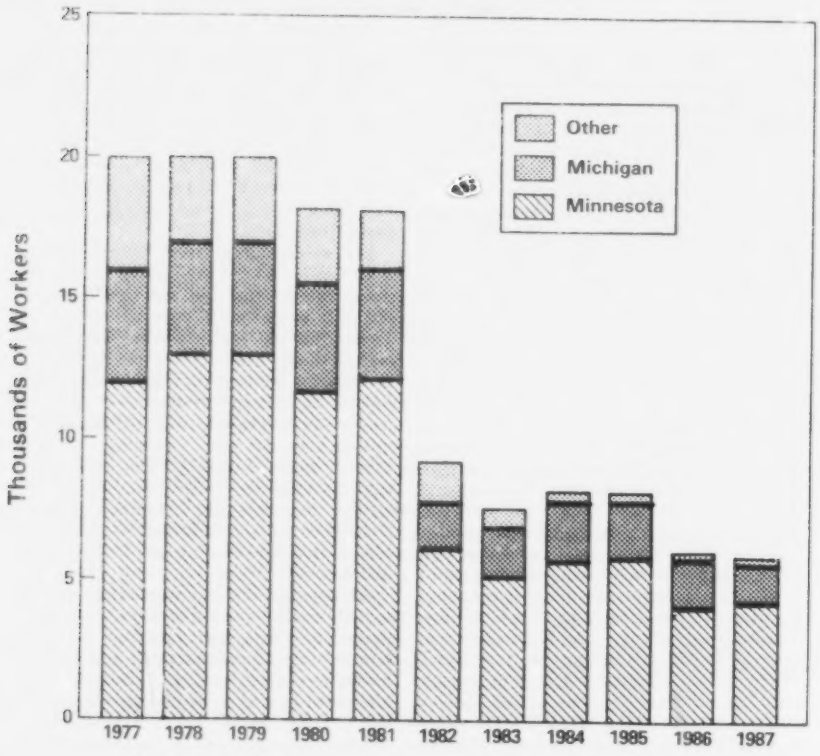

Figure 2.—Employment at iron mines and beneficiating plants.

Average quarterly employment was 4% lower than that of 1986, but total hours worked were slightly higher. At the same time, the output of usable ore jumped by 20% to meet increased pellet demand from domestic steel producers. The increase in demand enabled the iron ore industry to more fully utilize its effective pelletizing capacity and achieve economies of scale. The increase also came during a period when significant improvements were being made in productivity and cost reduction. In the Lake Superior district, which accounts for the bulk of U.S. output, average productivity for usable ore was 21% higher than that of 1986 and 86% higher than that of 1981. The significant gain since 1981 is primarily the result of drastic reductions in employment in 1982 and 1986 made by the principal producers, who were being battered by plummeting demand for domestic steel and a high level of steel imports. The two contractions have reduced installed pelletizing capacity by 19%. In 1987, pellet supply was more closely balanced with demand. For the first time in 9 years, the U.S. iron ore industry escaped permanently closing or indefinitely idling a pelletizing plant. As a result, U.S. production was concentrated in just eight large-scale taconite operations in the Lake Superior district.

The contraction of the iron mining and steel industries also led to an older work force, since younger workers traditionally have been laid off first. In the steel industry, the average age has edged up to about 44 from 40.6 in 1979.[3] In comparison, the average age of the employees at the revitalized Divrigi operations in Turkey is only 23.[4]

DOMESTIC PRODUCTION

The USX labor settlement and a strengthening of demand from the iron and steel industry were largely responsible for the 20% increase in iron ore production from the 1986 level of 38.86 million tons. The increase neutralized the downturn suffered by the domestic iron ore industry in 1986. Shipments of ore and agglomerates had dropped 16% between 1985 and 1986, putting several already financially troubled mine owners in a difficult position. Fortunately, the iron ore industry was able to turn around the situation in 1987 by reducing costs, recapitalizing, and improving pellet quality. A 12% increase in demand from Canada also helped. Total output of usable ore was equivalent to about 55% of installed production capacity on January 1.

An upturn in U.S. blast furnace activity during the fall offset a disappointing first quarter for the mine owners. Production of usable ore in the first half of the year was 10% lower than that in the comparable period of 1986. Similar declines occurred for mine shipments (14%) and pig iron production (10%). However, the monthly output of pig iron jumped from 2.74 to 3.47 million tons between February and March and kept growing for the rest of the year. In the end, 1987 pig iron production was 10% greater than that of 1986. The increase in pig iron output and the accompanying increase in demand for ore and agglomerates resulted from the resumption of iron and steelmaking by USX and the strengthening of overall demand for steel products in the fourth quarter. Secondary factors contributing to the turnaround were rising scrap prices; weakening of the U.S. dollar against the Japanese yen and major European currencies, which made the importation of some steels less attractive; rebuilding of inventories of finished steel that were depleted during the USX dispute; and increased exports of machinery and other goods fabricated from steel.

Iron ore was produced by 18 open pits and 1 underground mine. Twelve mines produced ore for the iron and steel industry, but only seven mines operated for the full 12 months. One taconite mine and its associated pelletizing plant remained idle throughout the year and another was being liquidated. Installed production capacity for usable ore at yearend was estimated at 84 million tons per year, including 75 million tons of capacity for pellets. Effective production capacity for pellets was at least 17 million tons less than installed capacity. Only four of the nine active pelletizing plants utilized more than 85% of their installed capacities.

An average of 3.1 tons of crude ore was mined in 1987 for each ton of usable ore produced. This ratio does not take into account the tonnage of waste rock or overburden removed. The ratio of total materials mined to usable ore produced was probably greater than 5 to 1. Low-grade ores of the taconite type mined in Michigan and Minnesota accounted for 99% of total crude ore production. U.S. production of pellets totaled 45.11 million tons, 96% of usable ore output. The average iron content of usable

ore produced was 64.2%.

The iron ore industry of the United States and Canada underwent a major restructuring in 1986 aimed at lowering operating costs and improving competitiveness. Many of the organizational changes were still being implemented in 1987. A few companies, like Cleveland Cliffs Inc. (CCI), even initiated new restructuring and recapitalization programs. However, the bankruptcy filings of LTV Steel Co. Inc. and the Wheeling-Pittsburgh Steel Corp. made it difficult for their venture partners to refinance and modernize jointly owned operations.

CCI acquired its long-time competitor, Pickands Mather & Co., from Moore McCormack Resources Inc. on December 30, 1986. As a result of this acquisition, CCI is now responsible for more than 40% of pellet production capacity in North America. A new subsidiary, Cliffs Mining Co., was established to manage both Cleveland-Cliffs Iron Co. and Pickands Mather. At the beginning of 1987, CCI had equity in six iron mining operations, one of which was idle. The active operations included the Tilden Mining Co. (39%) and the Empire Iron Mining Partnership (5%), both of Michigan; the Hibbing Taconite Co. of Minnesota (15%); Wabush Mines of Labrador and Quebec (5.2%); and the Savage River Mines of Tasmania (36%). Pickands Mather also continued to manage the Erie Mining Co. of Minnesota for LTV Steel. The integration of Pickands Mather and the refocusing of CCI on its core iron ore business triggered a string of events that led to a restructuring and recapitalization of the amalgamated company. The management of CCI abandoned its earlier diversification strategy and began selling or spinning off its peripheral operations.

On April 17, Sharon Steel Corp. filed for protection under chapter 11 of the Federal Bankruptcy Code, adding to the complexity of the financial problems faced by CCI. Sharon Steel's filing put Tilden, which was operated and partly owned by Cleveland-Cliffs Iron, in a precarious situation. At the time of the filing, two of the four other partners in the Upper Peninsula venture—LTV Steel and Wheeling-Pittsburgh—were already involved in bankruptcy proceedings. Ownership in the mining complex was shared between Cleveland-Cliffs Iron, 39% equity; The Algoma Steel Corp. Ltd., 30%; LTV Steel, 12%; Stelco Inc., 10%; Sharon Steel, 5%; and Wheeling-Pittsburgh, 4%. However, Cleveland-Cliffs Iron had been absorbing the carrying cost of LTV Steel's interest since July 1986 when LTV Steel filed under chapter 11. Wheeling-Pittsburgh had been in technical default since April 1985.

On September 30, CCI bought back $126.4 million of Tilden long-term debt obligations from eight institutional lenders. The company purchased the notes for $106.0 million, a discount of $20.4 million, using $62.4 million obtained from the sale of 4 million shares of common stock and $43.6 million in cash. The transaction eliminated principal and interest payments of nearly $30 million per year for Cleveland-Cliffs Iron, and removed the threat of debt acceleration that was overhanging the Tilden partnership. As a result of the debt restructuring, CCI held a total of $52.6 million of Tilden notes backed by LTV Steel, Sharon Steel, and Wheeling-Pittsburgh.

The three solvent partners also began exploring ways of making Tilden more competitive. One proposal recommended that the beneficiation equipment at Tilden be converted to handle magnetite feed instead of hematite. The more easily processed magnetite ore would come from reserves at Schoolhouse Lake, just north of the existing pit. Magnetic separation techniques would drastically reduce the operation's concentrating costs, but the development of the new pit and conversion of the equipment would cost $25 million. A second proposal called for a 50% reduction in pellet production capacity from the existing 8.0 million tons per year. The partnership was still evaluating the two proposals at yearend, but was expected to approve both in early 1988.

On August 14, Cleveland-Cliffs Iron signed a letter of intent to sell its Presque Isle powerplant and related coal-handling facilities at Marquette, MI, to Wisconsin Electric Power Co. for $247.5 million. The 592-megawatt coal-fired plant supplied all of the electrical power required by both Empire and Tilden. At the time of the announcement, Cliffs had a 93% interest in the Upper Peninsula Generating Co., which in turn owned the plant. The remaining 7% was held by the Upper Peninsula Power Co. of Houghton, which operated the plant for the iron ore company. The sale of the Presque Isle plant to Wisconsin Electric was completed on December 30. The Milwaukee-based utility continued to serve the two taconite mines from Presque Isle under new

long-term contracts, but could send any excess power through the existing grid to other customers. The transaction significantly reduced energy costs for the two mines.

On January 31, 46 of 47 locals of the USWA overwhelmingly ratified a new 4-year contract with USX. The vote ended a labor dispute that had shut down the company's entire USS Div. for 184 days. This was the longest work stoppage in the history of the domestic steel industry. Local 1938, made up of 1,300 workers at USX's Minntac Mine and pelletizing plant in Mountain Iron, MN, was the only bargaining unit to reject the agreement. The record-breaking labor dispute began August 1, 1986, when the previous contract expired and negotiators were unable to reach an agreement on either wages or the use of nonunion contractors. Analysts estimate that the work stoppage cost USX $3 billion in orders. The new contract permitted USX to eliminate 1,346 jobs through craft combinations and work-rule changes. The union also agreed to wage and benefit concessions that equated to at least a 7% savings for USX over the life of the contract.

Ratification enabled USX, the Nation's largest steelmaker, to proceed with its corporate restructuring program and to reduce its annual steelmaking capacity by about 27% to 19 million short tons. Management warned the USWA prior to the stoppage that USX was considering closing several facilities to increase its competitiveness. The restructuring led to the closure and eventual sale of the Geneva Works near Provo, UT. Two other steelmaking facilities were idled indefinitely, together with the sinter plant at Saxonburg, PA. The restructuring trimmed about 3,700 employees from the steel group's 22,000-plus payroll.

Operations were resumed at Minntac on May 17. However, USX management cut back the production rate to 9.2 million tons of pellets per year from the previous level of 12.5 million tons. The production cutback was dictated in part by the shutdown of Geneva. Geneva had been a major user of Minntac pellets since 1983 when the company closed its last western mine at Atlantic City, WY. Although the labor dispute was settled in January, USX management decided to keep the mining complex closed for an additional 3-1/2 months until excess pellet stocks at the remaining reopened blast furnaces were drawn down to satisfactory levels. Only four of the grate-kiln lines at the Minntac pelletizing plant were restarted. The facility has a total of 7 grate-kiln lines with an aggregate design capacity of 18.5 million tons. The Minnesota division recalled about 200 salaried and 950 hourly employees, less than two-thirds of its 1985 staff, to meet the reduced production target. Minntac remained the largest taconite operation on the Mesabi Range, despite the cutbacks.

On September 1, Basic Manufacturing and Technologies of Utah Inc. purchased Geneva, the only integrated steel plant operation west of the Mississippi, from USX for an undisclosed sum. It was renamed Geneva Steel of Utah and initially employed 872 steelworkers and about 200 managerial and clerical people, down from a combined total of more than 2,100 in 1986. The plant's principal products were plate, hot-rolled coil, and welded pipe. Minntac was continuing to provide acid pellets for the two blast furnaces at Geneva as part of the purchase agreement.

Mining was resumed in the Iron Springs mining district of Iron County to provide feed for the sinter plant.[3] Plus 3/8-inch coarse ore and minus 3/8-inch fines averaging 56% iron (Fe) were being transported 230 miles on the Union Pacific Railroad to Geneva. The actual mining was contracted out to the Gilbert Development Corp. Run-of-mine ore was being crushed and screened at the Comstock Mine, a property leased by Geneva from CF&I Steel Corp. of Pueblo, CO. Gilbert Development was also producing its own magnetically cobbed material from stockpiled ore at the Mountain Iron Mine, 4 miles to the southwest. The Mountain Iron property was leased directly by Gilbert Development from CF&I. The district, 15 miles west of Cedar City, has provided magnetite and hematite ores for blast furnaces in the Rocky Mountain region on an intermittent basis since 1923.

Initial efforts by Armco Inc. and the State of Minnesota to reopen the bankrupt Reserve Mining Co. were unsuccessful. On January 9, the court-appointed trustee for Reserve announced that the company's Peter Mitchell Mine at Babbitt and the E. W. Davis pelletizing plant at the nearby port of Silver Bay would be permanently closed. The two operations had been on standby for more than 6 months as a result of the chapter 11 bankruptcy filing of LTV Corp. Armco, LTV's partner in the joint venture, could not carry the entire cost of operating Reserve by itself and suspended production

on July 21, 1986, 4 days after LTV's filing. Armco was unable to attract a new partner and was forced to place Reserve in chapter 11 bankruptcy on August 7, 1986.

Under the closure agreement, most of Reserve's 800 laid-off employees became eligible for pension and limited health insurance benefits. A new pension fund was to be established with $650,000 from the sale of stockpiled pellets, 10% of the profits from selling part of Reserve's assets, and 15% of the $16 million owed Reserve by the State of Minnesota for an occupation tax overcharge. The Pension Benefit Guaranty Corp., an agency of the Federal Government, would guarantee the basic benefits in Reserve's existing plans if it found them underfunded. Parts of the pelletizing plant and equipment were being maintained in a standby mode in the hope of eventually finding a buyer. The USWA locals also ended their blockade of the plant entrances as part of the agreement. Union officials set up the blockade September 1, 1986, in order to prevent the trustees from selling any of Reserve's equipment or stockpiled pellets until health benefits were restored to the employees. The entire agreement was being reviewed by a Federal bankruptcy judge in New York City. On January 22, the Governor of Minnesota approved a $25,000 study to determine whether reopening Reserve under new management would be economically possible.

In a related action on January 27, the Minnesota Pollution Control Agency Board approved Reserve's request to reduce the number of its environmental monitoring sites at the Milepost 7 tailings basin northwest of Silver Bay. The concentration of airborne, asbestos-like, silicate fibers had dropped dramatically since the company shut down its pelletizing plant and halted the flow of taconite tailings into the basin. The monitoring program would be reevaluated periodically by the State to ensure that the air and water quality of the basin area did not deteriorate. If Reserve remained closed, an estimated $57 million would have to be spent to decommission the sprawling tailings basin.

In September, the trustee for Reserve decided to release all of the pellets left in the Silver Bay stockpile. A total of 164,991 tons had been sitting at the port since the 1986 shutdown. All of this material was taken by LTV Steel in early October. An additional 17,762 tons of pellets was recovered during cleanup operations and shipped out in November. Since then, the State of Minnesota established an interagency task force to explore the possibility of reopening both the mine and the pelletizing plant. Armco expressed a willingness to buy up to 900,000 tons of pellets annually from a successfully restructured operation, but many roadblocks to reopening remained. The recent sale of one-half of the flotation cells and other equipment considered excess by the trustee reduced the effective annual production capacity of the pelletizing plant from 6 million tons to 4 million tons. When Reserve went into production in August 1955, it had a design capacity of 3.75 million tons. However, improvements made between 1957 and 1966 raised the design capacity in steps to about 9.8 million tons.

Minnesota produced 72% of the national output of usable ore in 1987. Production of pellets totaled 32.15 million tons, equivalent to about 62% of installed production capacity of the State's six active taconite plants.[6] The remainder of the output consisted of hematite concentrates produced from natural ores by LTV Steel and Rhude & Fryberger Inc.

A total of seven taconite plants were operable in 1987, but one—the E. W. Davis Works at Silver Bay—was left idle throughout the year by the bankruptcy filings of LTV and Reserve. An eighth, the Butler Taconite facility near Nashwauk, was being dismantled by Investment Recovery Systems Inc. Butler's former operator, M. A. Hanna Co., shipped the last 125,000 tons of pellets left in the defunct operation's stockpiles at the port of Superior.

All of LTV's natural ore production came from its McKinley Extension Mine north of Aurora. In July, Rhude & Fryberger stopped processing ore at its Rana Mine on the outskirts of Kinney and suspended all shipments indefinitely on October 31. The company had already halted operations at its Plummer-Diamond property in 1986. The Pittsburgh Pacific Co. shipped only 90 tons of concentrates recovered from natural ores stockpiled at the Connie Mine and permanently closed the last of its eight beneficiating operations on the Mesabi Range. The two closures left LTV the only active supplier of beneficiated natural ore in the Lake Superior district.

National Steel Pellet Co. (NSPC) was operated from January 1 to June 7 and from August 2 to December 31, producing 4.31 million tons of pellets. As the result of improvements in productivity, the Keewa-

tin Mine and pelletizing plant now has an effective annual pellet production capacity of 4.7 million tons.

On November 14, rank-and-file employees at the complex ratified a new 21-month contract, narrowly averting a strike. The new contract, which expires August 1, 1989, froze wages and reduced Sunday premium pay from time-and-one-half to time-and-one-quarter. Vacation pay was also cut. In exchange for the concessions, hourly workers became eligible for a profit-sharing plan tied to the profits of the parent company, National Steel Corp. In addition, pension benefits were improved and new limits were placed on outside contracting. The 370 employees, represented by USWA Local 2660, had been without a contract since July 31, 1986, when contracts for all six taconite operations on the Mesabi Range expired. Four of the six mines had negotiated new contracts that reduced or froze wages and benefits prior to the NSPC settlement. At yearend, LTV Steel Mining Co. was the only operation left on the Mesabi Range that was operating without a contract.

At the time of the labor settlement, both NSPC and Eveleth Mines were negotiating with the Minnesota Power and Development Co. for a reduction in long-term electric power rates. In recent years, power has accounted for about 27% of NSPC's production costs. Under its existing 10-year contract, NSPC was obligated to pay the cost of having a minimum amount of electrical capacity on hand, regardless of usage. All of the taconite companies on the Mesabi Range signed such long-term take-or-pay contracts in the 1970's to avoid building their own generating plants. However, these contracts worked against NSPC and the others when they were forced to shut down for extended periods during the recent recession.

The Erie Mining Co. was renamed LTV Steel Mining Co. in February. The name change eliminated some of the confusion generated by a complex exchange of equity interests in May 1986. At that time, LTV Steel, Bethlehem Steel Corp., Stelco, and Acme Steel Co. (then Interlake Inc.) traded holdings in Erie and two other iron mines. As part of the agreement, LTV Steel relinquished its interests in both the Hibbing Taconite Co. and the Iron Ore Co. of Canada (IOC) in exchange for full ownership of Erie.

Pickands Mather continued to manage Erie for LTV Steel. The 11-million-ton-per-year complex at Hoyt Lakes operated continuously throughout the year, except for a 5-week vacation period beginning in late June. On a normal day, at least 22 of the 27 shaft furnaces would be running in the pelletizing plant. The Hoyt Lakes plant produced 6.66 million tons of pellets and 114,000 tons of chips in 1987 and shipped 6.98 million tons of pellets and chips through the port of Taconite Harbor. The production included sizable amounts of fluxed pellets shipped to LTV Steel's Cleveland Works for blast furnace trials. The fluxstone was being shipped from Michigan to Taconite Harbor, where it was loaded into rail cars returning to Hoyt Lakes.

During the first half of 1987, low-silica taconite was mined at the Dunka Pit, 22 miles northeast of Hoyt Lakes, and blended with Hoyt Lakes ores to reduce the silica content of the pellets. In August, the company installed a flotation circuit at the concentrator to help lower the silica content of the final concentrate from 4.65% to about 3.70%.[1] The four-line flotation circuit was acquired from the closed Carr Fork copper mine in Utah and was scheduled to start up in mid-1988. Carbinder and several other organic binders were being evaluated to further lower pellet silica.

Hibbing Taconite operated from January 10 to yearend and produced a record high 7.82 million tons of acid pellets, averaging 64.66% Fe and 4.74% SiO_2 on a wet basis. In mid-April, the company began increasing pellet production from an annual rate of 5.5 million tons to full capacity—9 million tons—to meet additional orders from Bethlehem Steel. All nine lines in the concentrator and all three furnaces in the pelletizing plant were operating by yearend. The Hibtac plant had a design capacity of only 8.1 million tons and had never operated above the 6.8-million-ton level. Recent improvements in the milling part of the operation have enabled the company to exceed the design limit set in 1979 when the processing facilities were expanded by 2.7 million tons. About 40 employees were added to the existing work force of 550. The mine and pelletizing plant were managed by the Pickands Mather subsidiary of CCI, which has a 15% equity in Hibtac. The Hibtac production increase helped offset losses at mines in Labrador and Quebec that were paralyzed by labor strikes during March and April. Bethlehem, which held a 70.3% equity in Hibtac, was also the largest partner in IOC. Stelco, the third Hibtac partner holding the remaining 14.7% equity, permanently closed its wholly owned Griffith Mine near Ear Falls, Ontario, Canada, in March 1986 and began relying heavily on shipments from its Wabush Mines joint venture in Labrador and Quebec.

The Minntac facility of USX was idle for

a total of 136 days, producing only 7.64 million tons of acid pellets or 41% of installed capacity. Although the pelletizing plant at Mountain Iron was designed to produce 18.5 million tons per year, its effective capacity is more like 12.5 million tons. Operations were resumed on May 17 after production had stabilized at the company's reopened steel mills. By mid-June, the mining complex had returned to its normal pellet production rate of 34,000 tons per day.

On October 9, management announced that it would spend $8 million to convert Minntac's four active grate-kiln systems to fluxed pellet production. A small percentage of nonfluxed, or acid, pellets would continue to be produced for steel customers whose blast furnaces could not use the new pellets. Minntac was also successfully using 1/16- to 1/4-inch-diameter particles of pulverized waste wood to fire two of the rotary kilns. Waste wood was supplying more than 40% of the energy used on both pelletizing lines and recently had been more cost-effective than natural gas.

Eveleth Mines halted operations in early December after meeting its production goal of 3.50 million tons of pellets. Eveleth had a design capacity of 6.1 million tons per year; however, the No. 1 grate-kiln system at the Fairlane plant had been down for some time, limiting production to 3.8 million tons.

Oglebay Norton Co., the facility manager and the only partner not making steel, was put in a difficult position in 1986 by the LTV bankruptcy filing. The bankruptcy court authorized LTV to reject Oglebay's long-term pellet sales contract and one of two vessel transportation contracts. LTV did not purchase any pellets from Oglebay in 1986 or 1987 under the existing long-term agreement and chose instead to raise the output of its wholly owned mine at Hoyt Lakes. Eveleth's other owners—Armco, the Rouge Steel Co., and Stelco—lessened Oglebay's predicament by agreeing to take the production share previously contracted to LTV. Oglebay continued to do business with LTV on either a cargo-by-cargo or seasonal basis.

For the first time, the entire run at Fairlane was dedicated to the production of partially fluxed pellets. The pellets contained a 1% limestone additive and were made using the organic binder, Peridur, in place of bentonite. The final product averaged 64.64% Fe, 5.00% SiO_2, and 0.017% P on a wet basis, with the lime (CaO) and magnesia (MgO) running 0.81% and 0.39%, respectively. The new Peridur-plus-limestone (PL) pellet was designed to improve the reducibility of the blast furnace burden and had been under full-scale development at Fairlane since 1984.

In mid-June, union workers at Eveleth ratified a new 34-month contract that cut their wages by 99 cents per hour and benefits by 63 cents per hour. The cut lowered the average union wage to about $12 per hour. At the same time, the 483 workers became eligible for incentive pay and regained some jobs lost to outside contractors. The new contract, which took effect July 1, also improved job security and streamlined grievance procedures. The workers, members of USWA Local 6860, had been negotiating with Oglebay for almost a year. The Eveleth agreement was similar to one worked out in January between the union and USX's Minntac operation. Rouge, which has a 31.7% equity in Eveleth, had threatened to cancel a 400,000-ton order for pellets unless labor costs were reduced.

Oglebay filed an environmental assessment plan with the Minnesota Department of Natural Resources in November, seeking approval to expand the north pit of the Thunderbird Mine toward the city of Virginia. Under the long-term plan, Eveleth would expand the pit by 400 acres and create three new stockpiles. One of these stockpiles would be located in the old Rouchleau Pit on the southeastern edge of the city.

On November 1, 1986, Inland Steel Mining Co. began converting its Minorca Mine near the city of Virginia to 100% fluxed pellet production. At the same time, the company's Chicago-based parent, Inland Steel Co., directed CCI to begin converting part of the Empire mining complex at Palmer, MI, to fluxed production. Inland continued to have a 40% equity in the Upper Peninsula joint venture. The blended fluxstone for both operations was being supplied by another Inland division, Inland Lime & Stone Co. A total of $17 million was budgeted to pay for the Minorca and Empire changeovers, improvements at the dolomite and limestone quarries in Michigan, and the installation of new equipment at various points to crush, transfer, and grind the fluxstone. The bulk of the fluxed pellets was to be used in the No. 7 blast furnace at Inland's Indiana Harbor Works in East Chicago, IN. (See "Consumption and Uses.")

Pelletizing operations were halted at Minorca from July 31 to August 30 so that the last phase of the conversion could be completed. A cone crusher and a flux grinding circuit were incorporated into the operation, and more burners were added to the furnace.[5] A variety of organic binders,

including Alcotac and Peridur, were being evaluated. The modified facility had an annual design capacity of 2.5 million tons of fluxed pellets and had begun making a product that assayed 61.50% Fe and 3.9% SiO_2 on a wet basis. Minorca produced 1.39 million tons of acid pellets and 832,000 tons of fluxed pellets in 1987.

Michigan produced 26% of the national output of usable ore in 1987. Production consisted entirely of pellets produced from ores mined at the Empire and Tilden Mines in Marquette County. Both mining ventures were managed and partially owned by Cleveland-Cliffs Iron. The company's wholly owned Republic Mine remained idle throughout the year. Production of pellets totaled 12.29 million tons, of which 7.63 million tons was produced at the Empire plant and 4.66 million tons was produced at Tilden. The Empire facility was operated throughout the year and produced at 95% capacity. In contrast, the effective utilization of Tilden for the year was only 58%.

In the last few years, Tilden was used as a swing operation because it produced pellet feed from hematite-rich taconite instead of magnetite-rich taconite. It is technically easier and considerably cheaper to beneficiate magnetite-rich taconite. Relatively simple magnetic separators can recover the magnetite, while the hematite must be selectively flocculated and passed through a series of flotation cells to remove accompanying silicates. Until now, the operation of this flocculation-flotation circuitry and the accompanying consumption of expensive flotation reagents made Tilden a higher cost producer than the adjacent Empire Mine, which recovers only magnetite. The development of the magnetite ores under Schoolhouse Lake was expected to change the economics of the entire operation. A breakthrough was achieved in early December when hourly workers at both Upper Peninsula mines ratified a new 3-year contract that called for wage deferrals to finance the $25 million project. At yearend, CCI still needed approval of its steelmaking partners and environmental regulators to proceed with the changeover.

Empire produced a record-high number of pellets in 1987 and began limited mining of its Cliffs Drive I ore body so that the beneficiating and pelletizing facilities could operate at full capacity in 1988. Empire and Tilden had begun producing significant tonnages of fluxed pellets for their steelmaking partners. Most of Empire's fluxed pellets, about 13% of the pelletizing plant's total output, went to Inland Steel. Two grades of fluxed pellets were produced at Tilden, accounting for more than one-half of its output for the year. Empire was using a 47-53 blend of dolomite and limestone made by Inland Lime & Stone Co. at its Gulliver, MI, quarry, while Tilden opted for a 70-30 blend from the Calcite and Cedarville quarries of the Michigan Limestone Operations Limited Partnership. The two fluxstone mixes were being shipped in self-unloaders to the docks at Presque Isle, where they could be stockpiled and later hauled to the pelletizing plants by truck.

In Missouri, Pea Ridge Iron Ore Co. produced about 700,000 tons of iron ore products at its underground mine near Sullivan. The bulk of the production consisted of 633,000 tons of olivine-enriched pellets made from magnetite concentrate. The mine and plant, wholly owned by Fluor Corp., were operated throughout 1987.

The addition of 5% olivine increases the reducibility of the pellet, while improving its high-temperature properties in the blast furnace and increasing its resistance to low-temperature breakdown. The olivine was being imported from Norway and ground on-site. Only two of five shaft furnaces were operating in the 1.65-million-ton-per-year pelletizing plant because of the shutdown of Lone Star Steel Co.'s blast furnace near Daingerfield, TX, in the first quarter of 1986. Lone Star had been a major customer of Pea Ridge together with the National Steel Corp. Pea Ridge continued to ship pellets on the Union Pacific Railroad for a distance of 100 miles to National Steel's Granite City steelworks, across the Mississippi River from St. Louis.

Pea Ridge also produced heavy-medium magnetite for coal cleaning, a variety of iron oxides for pigments and use in ceramic magnets, as well as hematite for use in well-drilling fluids. The company was one of the few sources of byproduct pyrite concentrate still operating in the United States.

Fluor completed a restructuring of its natural resource investments in 1987 that resulted in the reconfiguring of its coal and lead subsidiaries and the sale of its gold and domestic zinc operations. In August, Fluor also took steps to divest itself of Pea Ridge and make the iron ore operation a quasi-independent subsidiary. The Missouri mine became part of Fluor when the California-based engineering and construction agglomerate acquired St. Joe Minerals Corp. in 1981.

CONSUMPTION AND USES

Consumption of iron ore was about 9% more than that of 1986, owing to increased demand from the iron and steel industry. Consumption for ironmaking and steelmaking totaled about 60.4 million tons, including 53.8 million tons in blast furnaces, 6.2 million tons in sintering plants, 0.3 million tons for production of direct-reduced iron (DRI), and 0.1 million tons in steelmaking furnaces. An additional 23,000 tons was used by the industry for miscellaneous and unspecified purposes. Consumption of iron ore for manufacture of cement, heavy-medium materials, pigments, ballast, and miscellaneous products was approximately 1.0 million tons.

In the iron and steel industry, monthly consumption of ore averaged 5.01 million tons, compared with 4.61 million tons in 1986. Consumption jumped 24% between February and March after USX settled with the USWA and resumed hot-metal production at its blast furnaces in Indiana, Ohio, and Pennsylvania. However, even after this jump, demand for ore was extremely weak in comparison with 1984 monthly data and still remained below the depressed levels of early 1986. Total consumption for the first 6 months was only 28.46 million tons, down 10% from the same period in 1986. On June 30, 47 blast furnaces were in operation, up from 32 at the beginning of the year.

A turnaround occurred in the second half of the year. Consumption began to pick up in August and continued rising until it peaked at 5.77 million tons in December. The increase in consumption resulted from the strengthening of overall demand for steel products, with shipments to industrial construction companies and machinery manufacturers showing the greatest growth. At yearend, 49 of the 87 blast furnaces available were on line.

Consumption of iron ore and agglomerates reported by integrated producers of iron and steel totaled 65.32 million tons, including 47.87 million tons of pellets, 16.53 million tons of sinter, and 0.92 million tons of natural coarse ore. Of the primary ore consumed, an estimated 73% was of domestic origin, 14% came from Canada, and 13% came from other countries.

Estimated consumption of other materials in sintering plants included 2.30 million tons of mill scale, 0.79 million tons of flue dust, 3.86 million tons of limestone and dolomite, 1.34 million tons of slag and slag scrap, and 0.69 million tons of coke breeze. Other iron-bearing materials charged directly to blast furnaces included about 34,000 tons of manganiferous iron ore, 1.27 million tons of steel-furnace slag, 0.17 million tons of mill scale, and 0.88 million tons of slag scrap.

The No. 7 blast furnace at Inland's Indiana Harbor Works was taken out of production for 96 days so that it could be relined with a newly developed refractory brick and modernized at a cost of $30 million. The unit, which has a working volume of 123,897 cubic feet, is Inland's most efficient ironmaking furnace and the largest in the Western Hemisphere. The furnace was being fed the new fluxed pellets produced at Minorca and Empire. The improvements were expected to increase the hot metal output of the furnace by 15% to 9,000 short tons per day.

On June 13, Wheeling-Pittsburgh halted all agglomerating operations at its Follansbee, WV, byproduct coke and sinter plant. The U.S. District Court for western Pennsylvania ordered the sintering part of the complex closed indefinitely because it failed to meet air pollution standards established under the Federal Clean Air Act. The ruling was an outgrowth of a suit brought against Wheeling-Pittsburgh by the U.S. Environmental Protection Agency. The company had been operating under the protection of Federal bankruptcy laws since April 1985 and was unable to provide the $3 million needed for additional emission control equipment. The closure forced the layoff of 100 workers and complicated pig iron production at the company's five blast furnaces across the Ohio River in Steubenville.

STOCKS

Stocks of iron ore and agglomerates reported at U.S. mines, docks, and consuming plants had been gradually dropping for more than 30 years. This trend slowed somewhat in 1987. At yearend, total industry stocks were only 20.59 million tons, down 8% from 1986. The decline was due primarily to a reduction of domestic ore stocks at furnace yards. Furnace yard stocks stood at 16.30 million tons, a 61% drop from the 42.27 million tons reported at the end of 1977. Combined stocks at furnace

yards and receiving docks included 12.77 million tons of domestic ores, 2.40 million tons of Canadian ores, and 3.16 million tons of other foreign ores. Mine stocks at yearend were 12% less than those of 1986, with the exhaustion of pellets from Reserve and Butler.

End-of-month stocks reported at mines peaked at 10.49 million tons in March and declined to 2.62 million tons at yearend, while stocks of ore at consuming plants ranged from a low of 9.03 million tons in May to a high of 16.30 million tons in December. As in previous years, these variations were principally caused by the seasonal nature of ore shipping on the Great Lakes.

Stocks of unagglomerated concentrates reported at pelletizing plants totaled 523,000 tons at yearend. This material is not included in mine stocks of usable ore reported in the accompanying tables because it is considered an intermediate product. Also, mine stock data after 1983 do not include byproduct ore, owing to the change in classification reported in this publication in 1983; data for previous years remain unchanged to avoid disclosing company proprietary information.

TRANSPORTATION

Vessel shipments of iron ore from U.S. ports on the upper Great Lakes totaled 47.08 million tons, about 24% more than those of 1986. Nearly 90% was destined for U.S. consumers, with the rest going to Canada. Shipments of iron ore through the St. Lawrence Seaway to U.S. ports on the Great Lakes totaled 4.07 million tons and accounted for about 25% of U.S. imports. The balance of imports, 12.51 million tons, was shipped primarily through ports on the east and gulf coasts.

Ore shipments from five of the seven U.S. ports on the upper Great Lakes increased from the levels of 1986, with the largest increase at Marquette, MI. Tonnage shipped from each port in 1987 was as follows:

Port	Date of first shipment	Date of last shipment	Total tonnage (thousand long tons)
Duluth, MN	Mar. 28	Dec. 25	7,595
Two Harbors, MN	Apr. 2	Jan. 14	7,122
Silver Bay, MN[1]			183
Taconite Harbor, MN	Mar. 31	Jan. 6	7,899
Superior, WI	Mar. 24	Jan. 7	11,313
Marquette, MI	Mar. 26	Jan. 12	7,062
Escanaba, MI	Mar. 6	Jan. 23	5,907
Total[2]			47,081

[1]Operations ceased after LTV Steel Co., the co-owner of Reserve Mining Co., filed for bankruptcy on July 17, 1986. All of the stockpiled pellets that remained at Silver Bay were shipped out Oct.-Nov. 1987.

[2]Covers the 1987 navigation season, which extended from Mar. 6, 1987, to Jan. 23, 1988.

Source: Lake Carriers' Association, 1987 Annual Report.

The number of vessel shipments from all seven ports totaled 1,313, indicating an average cargo of 35,858 tons. Individual cargoes of 60,000 tons or more were loaded at six of the ports during the year, although the average shipment from individual ports ranged from 23,004 tons at Marquette to 45,138 tons at Taconite Harbor, MN.

Between November 1986 and June 1987, precipitation over the Great Lakes basin was 25% below normal. As a result, the abnormally high water levels of 1985-86 on the Great Lakes receded during the year, reducing iron ore loadings of the larger carriers to normal tonnages. To meet the strong demand for iron ore during the fourth quarter, the U.S. Army Corps of Engineers agreed to keep the Soo Locks open until January 15, 1988, instead of the traditional closing date of December 15. The shipping season formerly ended in mid-December because natural ores, once the predominant cargo, would freeze in the hold and could not be unloaded. However, the lower moisture content of present-day taconite pellets and the advent of vessels with hulls strengthened against ice enable the industry to operate until early January.

Lake freight rates for iron ore on January 1, 1987, were those that had been in effect since April 1984. On November 10, the published rates for self-unloaders were dramatically lowered and discounts were created to encourage the use of Class X vessels (i.e., vessels with hulls greater than 1,000 feet in length). The rates were as follows:

From	To	Dollars per long ton		
		Apr. 1984	Nov. 10, 1987[1]	
			Class X	Other
Head of the Lakes	Lower lake ports	7.41	4.50	5.25
Marquette	do	6.11		4.40
Escanaba	Lake Erie ports	5.64	3.40	3.95
Do	Lower Lake Michigan ports	4.45	2.70	3.00

[1]Excludes winter surcharges for shipments after Dec. 15 and before Apr. 15.

Sources: Cliffs Mining Co., Skillings' Mining Review, and Interlake Steamship Co.

Published bulk vessel freight rates from the Gulf of St. Lawrence to Lake Erie and Lake Michigan were $5.00 and $7.00 per ton, respectively. Freight rates for self-unloading vessels were $1.50 per ton higher. These rates may include toll charges on the St. Lawrence Seaway, which amount to about $1.24 per ton.

The two principal issues concerning U.S. lake shipping in 1987 continued to be the proposed construction of a second Poe-class lock at Sault Ste. Marie and the question of sharing domestic lake and coastal trade with Canadian vessels. The latter issue was rejuvenated during the Free Trade Area Agreement negotiations with Canada, and caused the Reagan Administration to review the justifications for existing cabotage laws.

At the present time, the Poe Lock is the only one at Sault Ste. Marie that can handle vessels with a length greater than 680 feet. Of the 59 dry-bulk cargo vessels registered in the U.S. Great Lakes fleet, 29 must use the Poe Lock to transit the St. Mary's Falls Canal. These 29 vessels account for more than 72% of active carrying capacity.[9] A lengthy shutdown of the Poe Lock could seriously disrupt lake shipping and sharply increase haulage costs in the region for iron ore and at least five other bulk commodities.

On November 17, 1986, the President signed the Water Resources Development Act (Public Law 99-662). Section 1149 of this law authorized construction of a second Poe-size lock. However, funding continued to be a problem. The new law required that a local sponsor pay 35% of the estimated $240 million construction costs. The States bordering the Great Lakes argue that foreign shipping would also use the proposed lock and, therefore, the Federal Government should bear the entire cost of the project. About 30% of the cargoes currently transiting the locks go to Canada or overseas. The Great Lakes States further argue that interior States like Montana, the Dakotas, and West Virginia likewise benefit from the locks. The position taken by the Lake Carriers' Association (LCA) is that the national defense role of the Soo Locks alone justifies full Federal funding. If Congress were to appropriate all of the necessary funds in 1989, groundbreaking could not take place until 1992, and the project could not be completed before 2001.

The cabotage issue is a complex one with serious long-term implications for the U.S. Great Lakes fleet. The United States has had cabotage laws since 1789 to ensure a reliable domestic shipping service and to be able to rapidly expand the Nation's maritime capabilities in the event of a national emergency. One of the key cabotage laws is section 27 of title I of the Merchant Marine Act of 1936. This section, known as the Jones Act, mandates that all domestic waterborne commerce be conducted in vessels that are U.S.-built, -owned, and -crewed.

The Government of Canada wanted these cabotage restrictions waived as part of the Free Trade Area Agreement. In exchange, U.S. vessels would have been allowed to carry cargo between Canadian ports. If approved, Canadian ore carriers would have been able to haul pellets from Duluth to Cleveland. United States and Canadian iron ore shipments on the Great Lakes for 1983 through 1987 are compared in the following tabulation:

Loading district	United States and Canadian iron ore shipments on the Great Lakes (thousand long tons)				
	1983	1984	1985	1986	1987
Lake Superior	35,056	38,152	37,363	31,177	41,174
Lake Michigan	7,416	8,619	7,385	7,378	5,907
Lake Huron	172	217			
Eastern Canada	9,440	10,276	7,423	6,996	7,981
Total[1]	52,085	57,265	52,171	45,551	55,063
U.S. flag fleet shipments[2]	NA	NA	43,332	38,834	48,155
Percent carried by U.S. fleet	NA	NA	83	85	87

NA Not available.
[1]Includes transshipments. Data may not add to totals shown because of independent rounding.
[2]Includes mill scale, scarfer ore, and slag, in addition to iron ore.

Source: Lake Carriers' Association Annual Reports.

The hard-pressed members of the LCA and other groups opposed the Canadian proposal because the Federal Government in Ottawa continued to contribute to the pension and health programs of the Canadian merchant marine and heavily subsidized its shipbuilding industry in the 1970's. Because of these and related arguments, the United States and Canadian negotiators decided to remove the maritime provisions from the final agreement. At yearend, the Free Trade Area Agreement was awaiting ratification by Congress and the Canadian Parliament.

The State of Wisconsin, the city of Superior, and the Burlington Northern Dock Corporation were still locked in litigation over a taconite tax passed by the State legislature in 1977. During the last 10 years, the railroad subsidiary had been required to pay a 5-cent-per-ton tax on pellets railed from the western half of the Mesabi Range to the company's Allouez terminal. Burlington Northern had protested the tax since its inception and had brought several suits against the city of Superior, which collects the dock tax and retains 70% of the monies. The remaining 30% is sent to the State treasury.

In June 1986, the Wisconsin Supreme Court ruled that the taconite tax was unconstitutional and violated the commerce clause of the U.S. Constitution by discriminating against ore mined outside of Wisconsin. The Wisconsin attorney general then appealed the ruling of the State court to the U.S. Supreme Court. On January 12, 1987, the Court upheld the State court's ruling, forcing the city of Superior and Wisconsin to refund the $5.4 million paid under protest by Burlington Northern between 1977 and 1985, plus interest.

In 1985, the State legislature changed the tax law and removed the part that the State supreme court had found objectionable. In May 1987, Burlington Northern sued the city again, claiming that the redrafted tax was also unconstitutional. At yearend 1987, negotiations were still in progress between city, State, and company officials.

Published railway freight rates for pellets from mines to upper lake shipping ports were unchanged in Minnesota in 1987. The volume rate for pellets from the western Mesabi Range to the Allouez docks at Superior remained at $5.01 per ton. For pellets from the Marquette Range of Michigan, the rate to Escanaba remained at $2.68 per ton. However, on January 18, the rate to Presque Isle was lowered from $2.40 to $2.15 per ton. Dock-handling charges at Duluth, Superior, and Escanaba ranged from 69 to 94 cents per ton.

Rail rates from lower lake ports to a number of consuming points were rolled back to 1985 levels in November 1986, but most of these rollbacks were erased at the end of 1987. Several other key rates were raised substantially at this time. Most ore transfer charges were also increased slightly at yearend. At Lake Erie ports, charges for transfering ore from rail-of-vessel or dock-receiving areas directly into railway cars ranged from $0.97 to $1.52 per ton. Key rail rates for 1986 through 1987 are compared in the following tabulation:

From	To	Type of rate[1]	Dollars per long ton		
			Jan. 1, 1986	Nov. 17, 1986	Jan. 1, 1988
Lake Erie ports	Pittsburgh and Wheeling districts	Multiple car	10.74	10.62	11.45
Baltimore, MD	Pittsburgh district	do	11.68	11.49	NA
Do	do	Single car	15.77	15.77	16.26
Philadelphia, PA	do	do	16.48	NA	17.57
Missabi Range	Granite City, IL	Multiple car	19.07	23.35	24.33
Pea Ridge, MO	do	do	6.41	6.41	6.41

NA Not available.
[1]As a result of the Staggers Rail Act of 1980, which partially deregulated the railroads, it has become difficult to obtain accurate freight rate data. Published tariff rates are only suggested rates and may be significantly higher than the actual contract rates.

Sources: Cliffs Mining Co., Skillings' Mining Review, and Minnesota Mining Directory.

All-rail shipments of pellets from Minnesota by the Duluth, Missabe and Iron Range Railway Co. and connecting lines amounted to only 431,000 tons, down from 1.5 million tons in 1985, because of the USX labor dispute and the subsequent idling of the Geneva Works near Provo, UT. Shipments to Geneva from the Minntac plant were resumed in the fourth quarter of 1987 after the steelworks were sold to Basic Manufacturing and Technologies of Utah. Some pellets were also hauled all-rail to National Steel's two blast furnaces at Granite City, IL. Shipments of pellets and small quantities of natural ore to the ports of Duluth and Two Harbors totaled 14.72 million tons for a total ore movement on the railway of 15.15 million tons during the 1987-88 shipping season.

Published nominal ocean freight rates for iron ore from eastern Canada to U.S. mid-Atlantic ports were $3.50 to $3.75 per ton, but spot rates quoted for cargoes of 60,000 to 95,000 tons ranged from $2.75 to $3.75 per ton. A few shipments reported from Brazil to east coast ports indicated freight rates of $4.50 to $4.95 per ton.

PRICES

In 1985, three Lake Superior producers adopted new price bases for their pellets in response to increasing competition between domestic and foreign producers in the U.S. market. Pickands Mather and Inland Steel Mining both began quoting a price of 59.4 cents per long ton unit (ltu) of iron, natural, delivered to hold-of-vessel at *upper* lake ports. For more than two decades, Lake Superior pellet prices had been quoted for delivery to rail-of-vessel at lower lake ports. USX made price comparisons even more difficult by quoting 72.5 cents per *dry* ltu of iron for Minntac pellets, delivered rail-of-vessel at lower lake ports. In 1987, domestic pricing was further complicated by the emergence of a significant spot market for pellets.[10] Spot sales of pellets first appeared in North America in 1982 when demand for steel collapsed because of the recession. Several steelmakers were starved for cash at the time, but had large, unneeded inventories of raw materials that could be resold. The subsequent bankruptcy filings of Wheeling-Pittsburgh and LTV helped the spot market to grow by nullifying a number of long-term purchase contracts.

In mid-January, Cleveland-Cliffs Iron reduced the price of its Lake Superior iron ore pellets from 86.90 cents per ltu of iron, natural, to 72.45 cents per ltu. The new price, which was retroactive to December 30, 1986, applied to pellets delivered rail-of-vessel at lower lake ports. The previous price of 86.90 cents had been in effect since February 26, 1982. In February, Oglebay announced an identical 16.5% reduction for its standard grade pellets, effective March 1. Oglebay's new Eveleth special grade was listed at 74.00 cents per ltu. Mineral Services Inc. continued to quote its August 1985 price of 58.0 cents per ltu. USX adopted a different strategy and switched its pricing, effective May 20, to an f.o.b. mine basis. The new price for Minntac acid pellets was 37.344 cents per *dry* ltu of iron, delivered into rail cars at the Minnesota mine. This price equated to about $23.87 per long ton of undried pellets containing 63.92% Fe and 2.29% moisture. Inland Steel then countered everyone by dropping the price of its Minorca pellets from 59.40 cents per ltu to 46.84 cents per ltu. The range of all of the above prices was approximately equiva-

lent to $34.50 to $55.62 per long ton of pellets containing 64% iron, delivered rail-of-vessel at lower lake ports.

Published prices for Lake Superior ores, per ton, basis 51.5% iron, natural, delivered rail-of-vessel at lower lake ports, remained as follows: Mesabi non-Bessemer ore, $30.03 for coarse ore and $31.53 for fines; and manganiferous ore, $32.78. These prices were not very significant in 1987 because most Mesabi non-Bessemer ore was produced and consumed by LTV Steel, and none of the manganiferous ore was mined. Pellets made up more than 96% of ore shipped from the Lake Superior district.

Prices for most Canadian and other foreign ores marketed in the United States were not available. The published price of Wabush pellets, f.o.b. Pointe Noire, Quebec, remained at 63.5 cents per ltu. The average f.o.b. value of all Canadian ores imported by the United States, as determined from data compiled by the Bureau of Census, was $31.34 per long ton. Data from this source indicated average f.o.b. values of $14.01 per ton for Liberian ores and $17.81 per ton for Brazilian ores. Other sources indicate that most imported Canadian ore consisted of pellets, Liberian ores consisted of fines and washed lumpy ore, and about two-thirds of the ore imported from Brazil consisted of pellets. F.o.b. value data for Venezuelan ores were not determinable because much of the ore was apparently valued on a c.i.f. basis.

Published f.o.b. prices for DRI were also unchanged from those quoted in 1986, and were as follows, per metric ton: at Georgetown, SC, $125 to $135; at Contrecoeur, Quebec, $115; and at Point Lisas, Trinidad and Tobago, $120. The apparent f.o.b. value of some shipments of DRI imported from Venezuela since 1985 ranged from about $79 to $110 per long ton.

FOREIGN TRADE

U.S. exports of iron ore were 12% higher than those of 1986 because of increased demand from the Canadian steel industry. Virtually all exports consisted of pellets shipped via the Great Lakes to Canadian steel companies that are partners in U.S. taconite projects in Minnesota and Michigan. Consumption of iron ore at Canadian blast furnaces totaled 13.08 million tons, about 5% more than that of 1986. This improvement in Canadian blast furnace activity was largely the result of a 9% increase in downstream shipments of rolled steel products.

U.S. imports for consumption of iron ore decreased slightly to 16.58 million tons. A 57% decline of imports into the Mobile customs district offset small increases for Baltimore, Chicago, and Philadelphia. Total tonnage for 1987 was still 7% greater than the mean of the previous 5 years, 15.49 million tons. For the first time in more than a decade, Canadian ores accounted for less than one-half of the total U.S. imports. In the last few years, Canada had struggled to maintain its traditional 13% to 23% share of the increasingly competitive U.S. market, which has shrunk 48% since 1979. Brazil, the next largest supplier after Canada, gradually increased its share from a 10-year low of 1.8% in 1982 to 6.1% in 1987.

In June, shipload quantities of Australian ore began arriving at east coast ports after a hiatus of 7 years. Considerably larger tonnages were scheduled for delivery from the Pilbara region of Western Australia in 1988. The Broken Hill Pty. Co. Ltd. (BHP) announced that Bethlehem had agreed to buy 108,000 tons of pellets from BHP's Whyalla works in South Australia. This sale would be BHP's first to Bethlehem since the Australian Government's iron ore embargo of 1938.

WORLD REVIEW

At least 46 countries mined iron ore during the year, producing a total of 869 million tons. The U.S.S.R. was the largest producer, with an output of 191.4 million tons of concentrate and 65.6 million tons of pellets. Soviet production accounted for about 27% of the world's marketable output in terms of metal content. World production of pig iron, which directly reflects ore consumption, increased slightly to 504 million long tons.

The world ore trade was estimated at 365 million tons, of which about 85% was oceanborne. Brazil, the leading exporter, shipped 96 million tons to world markets in 1987, an amount 5% greater than that of 1986. Shipments from Australia, the second largest exporter, dropped from 81 to 79 million tons because of reduced imports by Japanese steelmakers, who cut back on pig iron

production by 2%. The recently expanded EC received 119 million tons of ore and agglomerates, edging out Japan as the world's principal importer. Japanese imports decreased 3% from 113 million tons to 110 million tons.

World production of pellets was estimated at 203 million tons, about 81% of installed capacity. Most pelletizing plants in Brazil, Canada, Sweden, and the U.S.S.R. operated close to rated capacity, contrasting sharply with the situation in the United States. The merchant plant in Bahrain was forced to suspend operations in early 1986 and had no production in 1987. The plant, which was inaugurated in late 1984, had difficulty operating in the midst of the Iran-Iraq war.

World output of DRI was estimated by Midrex Corp. at 13.4 million tons, about 61% of installed capacity, as low prices for ferrous scrap continued to limit production.[11] Negotiations were under way to relocate the two-module plant of Norddeutsche Ferrowerke (Nord Ferro) at Emden, Federal Republic of Germany, to India. The permanent closure of the 0.87-million-ton-per-year West German plant, along with that of a plant in New Zealand, offset the startup of additional capacity at Kursk in the U.S.S.R. These changes reduced global DRI capacity from 23.2 million tons to 22.0 million tons. The improved utilization of existing gas-based facilities in Egypt, Mexico, the U.S.S.R., and Venezuela were largely responsible for the 9% increase in world DRI production between 1986 and 1987. About 47% of the total output for 1987 was produced in Mexico, Venezuela, and other countries in Latin America.

In the past, iron ore exporters normally completed their annual price negotiations in Europe before fixing prices in Japan. The tradition arose because European contracts are based on the calendar year, while Japanese contracts are on an April-to-March fiscal year. This year, in a break from tradition, BHP settled its Mount Newman contract with Japanese steelmakers on February 20, triggering a worldwide reappraisal of iron ore prices. Japanese ore buyers were able to complete most of their fiscal year 1987 price negotiations with foreign producers by September. In almost every case, irrespective of ore type, the new price was lower than that for fiscal year 1986. Price cuts for fines and lump ore ranged from 3.8% to 6.8%. European steelmakers, who were dissatisfied with their 1986 contracts, also succeeded in winning price cuts of 6% to 11% for fines, but were forced to pay 1% to 5% more for pellets.

On an f.o.b. (shipping port) basis, most 1987 prices apparently ranged from about $10.80 to $16.50 per long dry ton (ldt) for fines, $15.20 to $18.70 per ldt for lump, and $18.10 to $27.20 per ldt for pellets. Delivered prices (at receiving port) were about $2 to $10 higher, depending on ocean freight costs. The Japanese contract prices are listed in the following tabulation, f.o.b., in U.S. cents per *dry* ltu of iron unless otherwise specified.

Country and producer	Ore type	Prices (Apr. 1-Mar. 31)	
		FY 1986	FY 1987
Australia:			
Hamersley Iron Pty. Ltd. and Mount Newman Mining Co. Pty. Ltd.	Lump ore	30.29	28.78
Do.	Fines	25.97	24.67
Robe River Iron Associates	do.	22.97	21.50
Savage River Mines Ltd.	Pellets	36.02	34.72
Brazil:			
Cia. Nipo-Brasileira de Pelotização (Nibrasco)	do.	35.29	35.29
Cia. Vale do Rio Doce (Carajás)	Fines	23.66	22.24
Cia. Vale do Rio Doce and Mineraçoes Brasileiras Reunidas S.A.	Lump ore	23.66	22.24
Mineraçoes Brasileiras Reunidas S.A.	Fines	24.21	22.76
Samarco Mineração S.A.	Pellet feed	19.46	18.29
Canada: Iron Ore Co. of Canada (Carol Lake)	Concentrates	22.44	21.26
Chile: Cia. Minera del Pacífico S.A. (El Algarrobo)	Pellets	36.10	34.72
India:			
Minerals and Metals Trading Corp. (Bailadila)	Lump ore	29.21	27.75
Do.	Fines	24.95	23.70
Liberia: LAMCO Joint Venture Operating Co.	do.	22.40	20.47
Peru: Empresa Minera del Hierro del Peru S.A.	Pellets	27.59	27.59
South Africa, Republic of:			
South African Iron and Steel Industrial Corp. Ltd.	Lump ore	[1]23.91	[1]22.34
Do.	Fines	[1]20.55	[1]19.15

[1]Price per dry metric ton unit.

Source: The TEX Report (Tokyo), v. 20, No. 4664, Apr. 20, 1988, pp. 12-13.

Ocean freight rates for iron ore reversed their long-term decline in January and began rising. Published rates for spot charterings to the EC from Western Australia ranged from $5.80 to $8.30 per dwt for cargoes of 120,000 to 140,000 dwt, compared with $5.30 to $7.30 in 1986. The 1987 rate ranges for other shipments to the EC are shown in the following tabulation:

Country	Loading port	Cargo size (thousand deadweight tons)	Rate (dollars per deadweight ton)
Brazil	South Atlantic ports	100-140	3.00- 8.00
Do.	do.	220-250	2.80- 3.65
Canada	Sept-Iles or Port Cartier	100-140	2.95- 5.20
Liberia	Buchanan or Monrovia	60- 80	3.50- 6.85
Mauritania	Nouadhibou	80-100	2.20- 4.30
Sweden	Narvik (Norway)	80-100	2.25- 3.50
Venezuela	Puerto Ordáz	40- 60	6.80-10.15

Sources: Drewry Shipping Consultants Ltd. (London), Maritime Data Network Ltd. (London), and The TEX Report (Tokyo).

Rates for cargoes of 120,000 to 140,000 dwt to Japan from Western Australia ranged from $4.40 to $4.90. Higher rates applied to Port Latta in Tasmania because it cannot accommodate vessels greater than 95,000 dwt and is farther from Japan. Rates to Japan from the Brazilian port of Tubarão for somewhat smaller cargoes were $5.30 to $9.50.

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[1]Physical scientist, Branch of Ferrous Metals.

[2]Unless otherwise specified, the unit of weight used in this chapter is the long ton of 2,240 pounds.

[3]Wall Street Journal. An Older Work Force Burdens Big Producers in the Basic Industries. Mar. 5, 1987, pp. 1, 21.

[4]Skillings, D. N., Jr. TDCI Now Operating World's Latest Iron Ore Pellet Plant at Divrigi in Anatollia Region. Skillings' Min. Rev., v. 76, No. 2, Jan. 10, 1987, pp. 14-21.

[5]Skillings, D. N., Jr. North American Iron Ore Industry in Major Recovery in 1988 To Reach Seven-Year Production Peak of 97.6 Million Gross Tons. Skillings' Min. Rev., v. 77, No. 31, Jul. 30, 1988, pp. 14-26.

[6]There was an error in the "Domestic Production" section of the 1986 chapter. Minnesota pellet production was 25.88 million tons in 1986, not 36.44 million tons as published. The 36.44-million-ton number was the 1986 production total for the Lake Superior district. As a result, the capacity utilization should have been 43%, not 61%.

[7]Skillings, D. N., Jr. U.S. Iron Ore Industry To Recover Moderately in 1987 to Level of 45 Million Gross Tons of Pellets and Ore. Skillings' Min. Rev., v. 76, No. 30, Jul. 25, 1987, pp. 14-23.

[8]Work cited in footnote 5.

[9]Lake Carriers' Association (Cleveland, OH). 1987 Annual Report. 98 pp.

[10]Kirsis, K. M., and P. J. Kakela. U.S. Spot Iron Ore Market: Prices, Buyers & Sellers. Skillings' Min. Rev., v. 76, No. 46, Nov. 14, 1987, pp. 4-9.

[11]Midrex Corp. Direct From Midrex. MIDREX Plants Produce 61% of World's DRI in 1987. V. 13, No. 3, 2d quarter, 1988, p. 10.

Table 2.—Employment at iron ore mines and beneficiating plants, quantity and tenor of ore produced, and average output per worker hour in the United States in 1987, by district and State

District and State	Average number of employees	Worker hours (thousands)	Production (thousand long tons)			Iron content (natural) (percent)	Average per worker hour (long tons)		
			Crude ore	Usable ore	Iron contained (in usable ore)		Crude ore	Usable ore	Iron contained
Lake Superior:									
Michigan	1,834	3,527	35,925	12,294	7,830	63.7	10.19	3.49	2.22
Minnesota	3,737	7,777	108,632	33,645	21,657	64.4	13.97	4.33	2.79
Total or average	5,571	11,304	[1]144,556	45,939	29,487	64.2	12.79	4.06	2.61
Other States[2]	210	363	1,209	878	557	63.4	3.33	2.42	1.53
Grand total or average	5,781	11,667	145,765	46,817	30,044	64.2	12.49	4.01	2.58

[1]Data do not add to total shown because of independent rounding.
[2]Includes California, Missouri, Montana, New Mexico, Texas, and Utah.

Table 3.—Crude iron ore[1] mined in the United States in 1987, by district, State, and mining method

(Thousand long tons, unless otherwise specified, and exclusive of ore containing 5% or more manganese)

District and State	Number of mines	Open pit	Underground	Total quantity[2]
Lake Superior:				
Michigan	2	35,925		35,925
Minnesota	9	108,632		108,632
Total[2]	11	144,556		144,556
Other States:				
Missouri	1		1,001	1,001
Other[3]	7	207		207
Total[2]	8	207	1,001	1,209
Grand total[2]	19	144,764	1,001	145,765

[1]Excludes byproduct ore.
[2]Data may not add to totals shown because of independent rounding.
[3]Includes California, Montana, New Mexico, Texas, and Utah.

Table 4.—Usable iron ore produced in the United States in 1987, by district, State, and type of product

(Thousand long tons and exclusive of ore containing 5% or more manganese)

District and State	Direct-shipping ore	Concentrates	Agglomerates	Total quantity
Lake Superior:				
Michigan			12,294	12,294
Minnesota	88	1,404	32,153	33,645
Total	88	1,404	44,447	45,939
Other States:				
Missouri		40	660	700
Other[1]	178	W		178
Total	178	40	660	878
Grand total	266	1,444	45,107	46,817

W Withheld to avoid disclosing company proprietary data; included with "Direct-shipping ore."
[1]Includes California, Montana, New Mexico, Texas, and Utah.

Table 5.—Shipments of usable iron ore[1] from mines in the United States in 1987

(Exclusive of ore containing 5% or more manganese)

District and State	Gross weight of ore shipped (thousand long tons)				Average iron content (natural) (percent)	Value (thousands)
	Direct-shipping ore	Concentrates	Agglomerates	Total[2]		
Lake Superior:						
Michigan			12,312	12,312	63.7	W
Minnesota	88	1,549	32,016	33,654	64.3	$1,012,788
Total reportable[2] or average	88	1,549	44,328	45,965	64.2	1,012,788
Other States:						
Missouri		40	705	744	65.9	W
Other[3]	437	(4)		437	59.3	8,678
Total reportable[2] or average	437	40	705	1,181	63.5	8,678
Total withheld						481,621
Grand total[2] or average	525	1,589	45,033	47,146	64.2	1,503,087

W Withheld to avoid disclosing company proprietary data; included in "Total withheld."
[1]Includes byproduct ore.
[2]Data may not add to totals shown because of independent rounding.
[3]Includes California, Montana, New Mexico, New York, Texas, and Utah.
[4]Included with "Direct-shipping ore" to avoid disclosing company proprietary data.

Table 6.—Usable iron ore produced in the U.S. Lake Superior district, by range

(Thousand long tons and exclusive after 1905 of ore containing 5% or more manganese)

Year	Marquette	Menominee	Gogebic	Vermilion	Mesabi	Cuyuna	Spring Valley	Black River Falls	Total[1]
1854-1980	507,608	329,269	320,334	103,528	3,286,994	70,336	8,149	8,618	4,634,836
1981	15,508	75	--	--	51,025	--	--	854	67,462
1982	6,874	--	--	--	23,898	--	--	241	31,013
1983	9,339	--	--	--	26,255	--	--	--	35,594
1984	12,982	--	--	--	36,697	--	--	--	49,679
1985	12,479	--	--	--	34,910	--	--	--	47,388
1986	10,558	--	--	--	[r]27,042	--	--	--	[r]37,600
1987	12,294	--	--	--	33,645	--	--	--	45,939
Total[1]	587,642	329,344	320,334	103,528	3,520,466	70,336	8,149	9,713	4,949,512

[r]Revised.
[1]Data may not add to totals shown because of independent rounding.

Table 7.—Average analyses of total tonnage[1] of all grades of iron ore shipped from the U.S. Lake Superior district

Year	Quantity (thousand long tons)	Content (percent)[2]					
		Iron	Phosphorus	Silica	Manganese	Alumina	Moisture
1982	32,173	63.50	0.018	5.40	0.13	0.31	2.60
1983	42,418	63.32	.018	5.35	.12	.29	2.64
1984	48,613	63.48	.018	5.28	.14	.32	2.66
1985	46,916	63.64	.016	5.17	.11	.29	2.63
1986	40,674	63.61	.015	5.21	.11	.29	2.66
1987	46,723	63.46	.014	5.12	.10	.24	2.41

[1]Railroad weight—gross tons.
[2]Iron and moisture on natural basis; phosphorus, silica, manganese, and alumina on dried basis.

Source: American Iron Ore Association, 1982-86. This series is no longer published. The 1987 data are based on information reported to the Bureau of Mines.

Table 8.—U.S. consumption of iron ore and agglomerates in 1987, by region

(Thousand long tons and exclusive of ore containing 5% or more manganese)

Region	Iron ore and concentrates[1]		Agglomerates[2]		Miscellaneous[3]	Total reportable
	Blast furnaces	Steel furnaces	Blast furnaces	Steel furnaces		
Great Lakes[4]	W	W	46,101	W	W	46,101
Northeastern, Southern, Western[5]	W	W	18,245	W	W	18,245
Undistributed	836	80	--	404	1,032	2,352
Total	836	80	64,346	[6]404	1,032	66,698

W Withheld to avoid disclosing company proprietary data; included with "Undistributed."
[1]Excludes pellets or other agglomerated products.
[2]Includes approximately 39,471 units of pellets produced at U.S. mines and 8,420 units of foreign pellets and other agglomerates.
[3]Includes iron ore consumed in production of cement and iron ore shipped for use in manufacturing paint, ferrites, heavy media, cattle feed, refractory and weighting materials, and for use in lead smelting.
[4]Includes Illinois, Indiana, Michigan, and Ohio.
[5]Includes Alabama, Kentucky, Maryland, Pennsylvania, Utah, and West Virginia.
[6]Includes an estimated 320 units of ore and agglomerates used for production of direct-reduced iron for steelmaking.

Table 9.—U.S. exports of iron ore, by country

(Thousand long tons and thousand dollars)

Country	1985		1986		1987	
	Quantity	Value	Quantity	Value	Quantity	Value
Canada	5,033	240,435	4,179	204,090	5,011	199,100
India			[1]	17		
Mexico	[1]	10	1	45	1	42
Netherlands			[1]	17		
Venezuela	[1]	22	[1]	29	1	95
Other	[1]	87	[1]	20	[1]	9
Total[2]	5,033	240,557	4,182	204,728	5,013	199,254

[1]Less than 1/2 unit.
[2]Data may not add to totals shown because of independent rounding.

Table 10.—U.S. imports for consumption of iron ore, by country

(Thousand long tons and thousand dollars)

Country	1985		1986		1987	
	Quantity	Value	Quantity	Value	Quantity	Value
Australia			10	86	191	5,141
Brazil	2,540	49,322	3,693	71,945	3,640	64,829
Canada	8,527	325,248	8,698	311,777	7,854	246,181
Chile	164	2,329	93	2,126	626	12,601
Liberia	2,296	31,614	1,487	21,855	979	13,367
Mauritania			65	1,158	466	6,403
Peru	121	2,722	91	2,429	87	1,691
Philippines			56	1,304	58	1,575
Spain					1	27
Sweden	65	1,503	104	2,473	137	3,334
Venezuela	[2]1,068	[2]39,369	[2]2,309	[2]42,126	[2]2,580	[2]62,803
Other	50	769	[r]138	[r]1,983	29	413
Total[4]	15,771	452,267	16,743	460,643	16,583	408,783

[r]Revised.
[1]Excludes approximately 214,000 long tons of sponge iron valued at $15,635,828, originally reported as iron ore.
[2]Excludes approximately 83,000 long tons of sponge iron valued at $8,340,609, originally reported as iron ore.
[3]Excludes approximately 18,000 long tons of sponge iron valued at $1,849,584, originally reported as iron ore.
[4]Data may not add to totals shown because of independent rounding.

Table 11.—U.S. imports for consumption of iron ore, by customs district

(Thousand long tons and thousand dollars)

Customs district	1985		1986		1987	
	Quantity	Value	Quantity	Value	Quantity	Value
Baltimore	3,673	71,363	5,567	144,725	5,881	125,887
Buffalo	[1]	5	[1]	25	[1]	30
Chicago	2,594	58,712	1,537	37,958	1,976	40,224
Cleveland	1,646	59,853	1,707	67,123	1,466	54,551
Detroit	542	19,107	382	17,398	627	27,196
Houston	165	2,541	42	745	9	177
Mobile	2,690	111,772	2,434	64,317	1,046	32,645
New Orleans	878	16,266	1,569	31,052	1,596	37,230
Philadelphia	3,408	107,029	3,237	90,592	3,749	103,101
Other	266	5,620	268	6,308	323	7,743
Total[2]	15,771	452,267	16,743	460,643	16,583	408,783

[1]Less than 1/2 unit.
[2]Data may not add to totals shown because of independent rounding.

Table 12.—Iron ore, iron ore concentrates, and iron ore agglomerates: World production, by country[1]

(Thousand long tons)

Country[2]	Gross weight[3]					Metal content[4]				
	1983	1984	1985	1986[p]	1987[e]	1983	1984	1985	1986[p]	1987[e]
Albania[e 5]	840	[6]1,063	1,100	[r]1,130	1,180	280	350	370	[r]375	395
Algeria	3,626	3,606	3,716	3,397	3,330	1,813	1,839	1,678	[r]1,650	1,650
Argentina	[r]581	[r]563	629	797	750	352	[r]341	383	506	476
Australia	69,916	92,900	91,392	92,648	98,400	44,583	57,400	[r]57,600	59,170	62,000
Austria	3,484	3,543	3,218	3,071	3,000	1,090	1,120	1,003	961	930
Bolivia	11					7				
Brazil	87,315	[r]110,361	126,225	130,199	129,500	57,064	[r]71,739	[r e]85,830	[r e]88,540	88,100
Bulgaria	1,775	2,030	1,954	2,145	2,170	545	612	597	651	655
Canada[7]	32,699	40,416	38,878	35,596	37,000	20,964	25,664	24,743	22,679	23,500
Chile	[r]5,717	[r]6,579	6,431	6,871	6,580	[r]3,434	[r]3,928	3,804	4,131	3,940
China[e]	70,000	74,000	79,000	88,600	98,100	35,000	37,000	39,000	44,300	49,200
Colombia	449	434	440	643	[6]605	202	195	198	[r e]220	270
Czechoslovakia	1,873	1,839	[r]1,870	[r]1,870	1,570	482	473	[r]480	[r]490	390
Egypt	2,188	1,871	1,919	2,101	2,170	1,094	935	960	[r]1,048	1,080
Finland[8]	1,257	1,212	[r]1,180	[r]590		809	776	[r]740	[r]380	
France	15,678	14,605	14,219	12,240	[6]10,739	4,981	4,606	4,464	3,800	[6]3,221
German Democratic Republic[9]	39	[r]35	30	[10]		20	20	30	[10]	
Germany, Federal Republic of	961	962	1,018	706	[6]243	275	288	304	209	[6]87
Greece[5]	1,322	1,899	2,210	1,178	[6]1,065	563	797	928	482	436
Hungary	434	377	396			104	91	74		
India	[e]38,187	40,378	41,873	47,045	[6]51,179	23,905	25,276	26,212	29,450	32,100
Indonesia	131	82	129	151	[6]191	76	47	75	88	[6]111
Iran[e 11]	[r]1,639	[r]2,668	[r]2,755	[r]2,760	2,760	[r]935	[r]1,536	[r]1,580	[r]1,580	1,580
Japan	293	319	333	286	[6]261	182	199	209	179	[6]163
Korea, North[e]	7,900	7,900	7,900	7,900	7,900	[r]3,150	[r]3,150	[r]3,150	[r]3,150	3,150
Korea, Republic of	645	615	533	573	460	[r]361	344	299	321	260
Liberia	14,701	14,862	15,076	15,053	[6]13,525	9,114	9,212	9,271	9,330	8,400
Malaysia	112	191	179	205	[6]158	69	117	109	125	[6]86
Mauritania[12]	7,268	9,377	9,186	8,788	[6]8,858	4,724	5,663	[r e]5,970	[r e]5,710	5,760
Mexico[13]	7,913	8,186	7,696	7,183	7,400	5,222	5,492	5,080	4,741	[6]4,897
Morocco	170	160	188	193	[6]207	104	99	116	121	[6]126
New Zealand[14]	2,168	2,376	2,480	[r e]2,540	[6]2,254	1,236	1,354	1,402	[6]1,400	1,289
Norway	3,489	3,776	3,413	3,601	[6]3,091	2,271	2,462	2,218	2,340	[6]2,010
Peru	[r]4,219	[r]3,916	4,815	4,956	4,770	[r]2,847	[r]2,621	3,238	3,303	3,200
Philippines	3					2				

See footnotes at end of table.

Table 12.—Iron ore, iron ore concentrates, and iron ore agglomerates: World production, by country[1] —Continued

(Thousand long tons)

Country[2]	Gross weight[3]					Metal content[4]				
	1983	1984	1985	1986[p]	1987[e]	1983	1984	1985	1986[p]	1987[e]
Poland	16	11	11	9	8	3	3	2	2	2
Portugal[15]	35	35	72	50	30	12	12	11	19	15
Romania	1,956	1,886	2,251	2,393	2,360	607	512	531	561	560
Sierra Leone	413	349	[e]50			260	219	[e]29		
South Africa, Republic of[16]	16,343	24,258	24,928	24,096	21,650	10,459	15,500	14,858	15,180	13,330
Spain[17]	7,331	7,146	6,361	5,993	3,740	4,457	3,502	3,139	2,734	1,870
Sweden	14,040	17,807	20,131	20,165	[e]19,317	9,124	11,003	13,287	[e]13,306	[e]12,073
Thailand	39	60	93	36	[e]37	22	32	51	21	[e]53
Tunisia	311	393	304	306	295	166	183	183	[r,e]164	160
Turkey	4,085	3,973	3,931	5,166	[e]3,313	2,213	2,157	2,129	2,798	[e]1,794
U.S.S.R.	241,329	243,291	243,728	246,911	247,000	131,454	132,640	133,852	134,936	135,000
United Kingdom	378	397	270	284	295	80	84	59	[e]63	59
United States[17]	37,562	51,269	48,751	38,892	[e]46,817	24,167	33,110	31,256	24,895	[e]30,044
Venezuela	9,562	12,848	15,972	18,823	17,500	5,924	7,965	9,902	[e]11,650	10,800
Yugoslavia	4,909	5,237	5,391	6,513	5,900	1,595	1,808	[e]1,770	[e]1,970	1,770
Zambia	1	1	1	1	[e]1	[18]	[18]	1	[18]	[e]1
Zimbabwe	911	912	1,083	1,092	1,000	[r]565	[r]566	671	677	677
Total	[r]728,247	[r]822,824	844,738	854,726	869,127	[r]417,859	[r]474,960	480,947	500,276	509,645

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through July 22, 1988.

[2]In addition to the countries listed, Cuba and Vietnam may produce iron ore, but definitive information on output levels, if any, is not available.

[3]Insofar as availability of sources permits, gross weight data in this table represent the nonduplicative sum of marketable direct-shipping iron ores, iron ore concentrates, and iron ore agglomerates produced by each of the listed countries. Concentrates and agglomerates produced from imported iron ores have been excluded, under the assumption that the ore from which such materials are produced has been credited as marketable ore in the country where it was mined.

[4]Data represent actual reported weight of contained metal or are calculated from reported metal content. Estimated figures are based on latest available iron ore content reported, except for the following countries for which grades are Bureau of Mines estimates: Albania, China, Hungary, and North Korea.

[5]Nickeliferous iron ore.

[6]Reported figure.

[7]Series reflects gross weight and metal content of usable iron ore (including byproduct ore) actually produced, natural weight.

[8]Includes magnetite concentrate, pelletized iron oxide (from roasted pyrite), and roasted pyrite (purple ore).

[9]Includes "roasted ore," presumably from pyrite, not separable from available sources.

[10]Revised to zero.

[11]Data are for year beginning Mar. 21 of that stated.

[12]Gross weight is exported iron ore (Mauritania exports all of its iron ore).

[13]Gross weight calculated from reported iron content based on grade of 66% Fe.

[14]Concentrates from titaniferous magnetite beach sands.

[15]Includes manganiferous iron ore.

[16]Includes magnetite ore as follows, in thousand long tons: 1983—3,414; 1984—3,780; 1985—3,550; 1986—3,940 (estimated); and 1987—4,000.

[17]Includes byproduct ore.

[18]Less than 1/2 unit.

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